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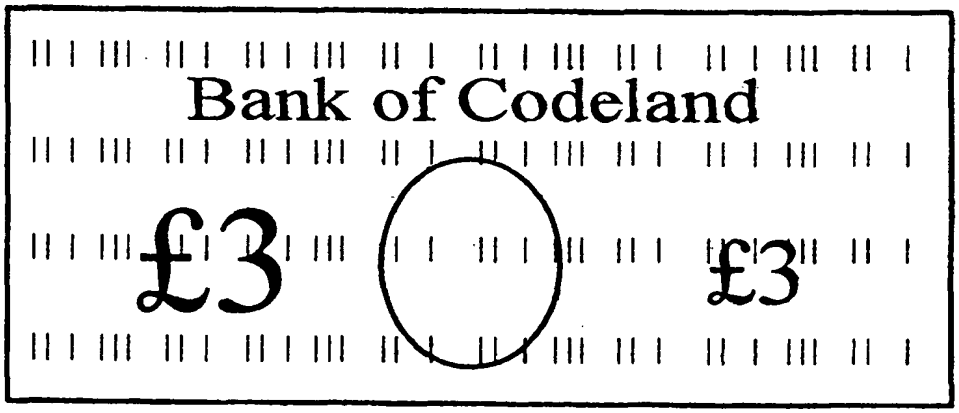
Published
With international search report.

(54) Title: SUBSTRATES FOR PRINTING



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(57) Abstract

A substrate on which a security document is to be printed. Said substrate having physically formed therein identification features which are invisible to the eye but are repetitive so as to be detectable by computer based equipment reading a document printed on said substrate.

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INTERNATIONAL SEARCH REPORT

Int. .tional Application No
PCT/GB 00/00129

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G07D7/00 G07D7/20 B41M3/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G07D B41M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 297 159 A (RICOH KK) 24 July 1996 (1996-07-24)	25,26
A	page 13, line 8 - line 28 page 171, line 6 -page 181, line 12 page 106, line 9 -page 111, line 9 figures 4,11,20-22,35	1,2,4, 8-10, 14-18, 20-24

X	EP 0 509 917 A (BANQUE DE FRANCE) 21 October 1992 (1992-10-21)	25,26
A	column 2, line 50 -column 4, line 18 column 8, line 48 -column 12, line 12 column 18, line 52 -column 19, line 15 figures 1-4	1-17

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 April 2000	11/04/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Bocage, S

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 00/00129

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category '	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 97 40619 A (UR SHMUEL ;BUSHINSKY SHAY H (IL); CHARNEY LEON H (US)) 30 October 1997 (1997-10-30) the whole document	26
A	US 4 715 623 A (CANTOR JOSHUA C ET AL) 29 December 1987 (1987-12-29) column 1, line 44 -column 2, line 31 column 5, line 32 -column 3, line 59 figure 1	1,5,16, 17,20, 23,24
A	EP 0 882 599 A (DE LA RUE GIORI SA) 9 December 1998 (1998-12-09) column 1, line 21 -column 4, line 44 column 5, line 11 -column 6, line 15	1-5,24
A	EP 0 664 642 A (OMRON TATEISI ELECTRONICS CO) 26 July 1995 (1995-07-26) abstract; claim 33	
A	US 3 922 539 A (CARNES W ROBERT ET AL) 25 November 1975 (1975-11-25)	

INTERNATIONAL SEARCH REPORT

Information on patent family members

In. .tional Application No
PCT/GB 00/00129

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2297159 A	24-07-1996	JP 6054186 A	25-02-1994
		JP 6062235 A	04-03-1994
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		JP 11215369 A	06-08-1999
US 3922539 A	25-11-1975	NONE	

PATENT COOPERATION TREATY

09/889475

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

KEITH W. NASH & CO.
90-92 Regent Street
Cambridge CB2 1DP
GRANDE BRETAGNE

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing *(day/month/year)*	17.05.2001
Applicant's or agent's file reference C569.01/B	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB00/00129	20/01/2000	26/01/1999

Applicant
THE GOVERNOR AND COMPANY OF THE BANK OF ... et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Atienza Vivancos, B Tel.+49 89 2399-7891

Form PCT/IPEA/416 (July 1992)

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
C569.01/B		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB00/00129	20/01/2000	26/01/1999
International Patent Classification (IPC) or national classification and IPC G07D7/00		
Applicant THE GOVERNOR AND COMPANY OF THE BANK OF ... et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 6 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
18/08/2000	17.05.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Houillon, J-C Telephone No. +49 89 2399 2640

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00129

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1,3-13	as originally filed			
2	as received on	08/12/2000	with letter of	29/11/2000

Claims, No.:

1-17	as received on	08/12/2000	with letter of	29/11/2000
18-25	as received on	17/03/2001	with letter of	14/03/2001

Drawings, sheets:

1/4-4/4	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:
   ☐ the claims, Nos.:
   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-24
	No:	Claims	25
Inventive step (IS)	Yes:	Claims	1-24
	No:	Claims	25
Industrial applicability (IA)	Yes:	Claims	1-25
	No:	Claims	

2. Citations and explanations
   see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

None of the documents cited in the procedure discloses or suggests the subject-matter of claims 1-24, which is thus novel and includes an inventive step.

The subject-matter of claim 25 does not appear to be novel with respect to the documents EP-A-882599 or EP-A-664642 (see abstracts for example).

Re Item VII

Certain defects in the international application

The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document EP-A-882599 not mentioned in the description, nor is this document identified therein.

usually readily visible to the naked eye, and it is not impossible to modify paper and other substrates in a similar manner, so as to confuse a verification process.

Object of the invention

It is one object of the present invention to provide a special substrate on which security documents can be printed, having features which will not be reproduced by a photocopier but which can be detected using a computer or other data processor based image system. However, the features will not normally be reproduced by a copier or printer supplied with image data signals obtained from an unprotected such system, as it can be arranged that if the computer system or copier detects the said features it can therefore refuse to process the image.

Summary of the invention

According to the present invention a substrate on which a security document is to be printed comprises a plurality of identification features in the surface thereof, which when illuminated and imaged by scanning produce data signals in the output of a photoelectric device characterised in that:

(1) the contrast between said identification features and the remainder of the substrate surface is such that image data signals corresponding to said features are substantially indistinguishable from image data signals relating to the remainder of the substrate surface and/or from background noise signals in the output of the photoelectric device, and are thereby indistinguishable by eye; and

(2) said features repeat at intervals over at least some of the surface area of the substrate, whereby upon validation the time or position signals relating to each feature will bear at least one fixed relationship to signals relating to other of said features, whereby a computing device supplied with the image data signals can be programmed to identify whether feature signals bearing the said at least one fixed relationship are present in the data, to assist in identifying the imaged document.

C569.00/B

Claims

1. A substrate on which a security document is to be printed comprising a plurality of identification features in the surface thereof, which when illuminated and imaged by scanning, produce image data signals in the output of a photoelectric device characterised in that:

(i) the contrast between the identification features and the remainder of the substrate surface is such that image data signals corresponding to said features are substantially indistinguishable from image data signals relating to the remainder of the substrate surface and/or from background noise signals in the output of the photoelectric device and are thereby indistinguishable by eye; and

(ii) the features repeat at intervals over at least some of the surface area of the substrate, whereby upon validation time or position of signals relating to each feature will bear at least one fixed relationship to signals relating to other of said features, whereby a computing device supplied with the image data signals can be programmed to identify whether feature signals bearing the said at least one fixed relationship are present in the data, to assist in identifying the imaged document.

2. A substrate according to claim 1, wherein the identification features are repeated at regular intervals.

3. A substrate according to claim 1 or claim 2, wherein each of the identification features is similar in character to each of the other features in the said surface.

4. A substrate according to any of claims 1 to 3, wherein the spacing of identification features is such as to be constant in one direction only or varied according to a special, known pattern, and similar or different regular spacings are selected for features in

another direction bearing a particular spacial relationship relative to the first said direction, for example perpendicular to said one direction.

5. A substrate according to any one of claims 1 to 4, wherein the features are arranged in a 2D matrix in the substrate surface.

6. A substrate according to claim 5, having a secondary encoding comprising a variation introduced into the matrix, such as by omitting features from particular positions in such a regular matrix.

7. A substrate according to claim 5, wherein the matrix comprises features having two distinctive types of characteristics, the features of one type being located at one set of positions in the matrix, and the features of the other type being located at other positions in the matrix.

8. A substrate according to any one of claims 1 to 7, wherein the identification feature encoded in the surface provides a primary encoding which will not appear in the electrostatic image of a photocopier.

9. A substrate according to claim 8, wherein the identification feature encoding is in the form of a repeating pattern.

10. A substrate according to claim 8 or claim 9, wherein the identification feature encoding comprises an embossing with inkless intaglio or an embossing of the surface by calendaring during manufacture of the substrate.

11. A substrate according to any one of claims 1 to 10, wherein two or more different encoding techniques are combined in the substrate.

12. A substrate according to claim 11, wherein the identification features are impressed in the surface of a substrate onto which a security document is to be printed, comprising

indentations and/or grooves in accordance with a first pattern which contains encoded therein a second pattern, thereby to enable a security document printed on such a substrate to be identified by subjecting image data signals obtained from scanning the document to an appropriate mathematical algorithm to determine whether the second pattern can be found in image data signals relating to the first pattern.

13. A substrate according to any one of claims 1 to 12, wherein the pattern is encoded to produce multiple iterations of a code on the substrate.

14. A substrate according to any one of claims 1 to 13, wherein the encoded pattern extends over selected areas which align with particular printed areas of the substrate.

15. A substrate according to claim 14, wherein the printed areas are such as to enhance the detection of the substrate surface variation during scanning and conversion of the image into image data signals.

16. A surface treated substrate in accordance with any one of claims 1 to 15, having any lighter and darker regions visible in the surface of a treated sheet of substrate when illuminated for scanning, but not visible to the eye.

17. A substrate according to claim 16, in which the identification features are embossed during its manufacture.

~~18. A substrate according to claim 16, comprising paper or plastics material mixed with~~ a resin or lacquer or other material to provide a smooth surface for printing, and an encoded structure in the surface such that the actual surface is sufficiently smooth to accept printing ink to enable a security document to be printed thereon, but at the same time contains a fine pattern of less smooth regions, which are less receptive of printing ~~ink.~~

18. A substrate according to claim 16, comprising paper or plastics material mixed with a resin or lacquer or other material to provide a smooth surface for printing, and an encoded structure in the surface such that the actual surface is sufficiently smooth to accept printing ink to enable a security document to be printed thereon, but at the same time contains a fine pattern of less smooth regions, which are less receptive of printing ink.

19. A substrate according to claim 16 wherein selected regions describe a repeat identification pattern by being impregnated with a fluid such as a resin, or lacquer, such that the optical absorbtion or reflectance characteristics or optical density of the substrate is altered sufficiently as between impregnated and non-impregnated areas as to be discernable under incident light.

20. A substrate according to claim 16, in which the surface is etched as by a laser beam, so as to produce cavities or grooves in the surface to be printed (or awaiting printing).

21. A substrate according to claim 16, comprising watermarking to vary the thickness and/or texture of a substrate, which variations can be rendered visible under incident light and form the primary and/or secondary encoding.

22. A security document substrate adapted to be identifiable as such by having detectable surface features therein according to any of claims 1 to 21, to enable identification as aforesaid.

23. A security document when printed on a substrate as claimed in any of claims 1 to 22.

24. A method of verification of a security document according to claim 22 or claim 23, wherein in a first step of verification a scanning process is employed to convert the image of the surface of the substrate of the document into image data signals for controlling a printing process, and when surface encoding is detected, a second step of verification is introduced by subjecting the image data signals to an appropriate algorithm, said second

step of verification, if failing, serving to downgrade or inhibit the printing process so as to prevent reproduction of the document, or at least a good quality reproduction thereof.

25. A method of verifying whether a document is a security document wherein a scanning process converts the image into image data signals for the subsequent control of a printing process and if the document is verified as a security document, the subsequent printing process is downgraded or inhibited to prevent a good quality reproduction of the document being reproduced.

Claims

1. A substrate on which a security document is to be printed includes a plurality of physical features in the surface thereof which when illuminated and imaged produce image data signals in the output of a photoelectric device characterised in that:

(i) the contrast between the features and the remainder of the substrate surface is selected so that image data signals corresponding to the features are substantially indistinguishable from image data signals relating to the remainder of the substrate surface and/or from background noise signals in the output of the photoelectric device and are thereby indistinguishable by eye; and

(ii) the features are repeated at intervals over at least some of the surface area of the substrate, whereby time or position of signals relating to each feature will bear at least one fixed relationship to signals relating to other of said features, whereby a computing device supplied with the image data signals can be programmed to identify whether feature signals bearing the said at least one fixed relationship are present in the data, to assist in identifying the imaged document.

2. A substrate according to claim 1, wherein the identification features are repeated at regular intervals.

3. A substrate according to claim 1 or claim 2, wherein each of the physical features is similar in character to each of the other features in the said surface.

4. A substrate according to any of claims 1 to 3, wherein the spacing of identification features is selected so as to be constant in one direction only or varied according to a special, known pattern, and similar or different regular spacings are selected for features in another direction bearing a particular spacial relationship relative to the first said direction, for example perpendicular to the said first direction.

5. A substrate according to any one of claims 1 to 4, wherein the features are arranged in a 2D matrix in the substrate surface.

6. A substrate according to claim 5, wherein secondary encoding of a substrate is achieved by introducing a variation into the matrix such as by omitting features from particular positions in such a regular matrix.

7. A substrate according to claim 5, wherein the matrix is formed from features having two distinctive characteristics and features of one type are located at one set of positions in the matrix, and features of the other type are located at other positions in the matrix.

8. A substrate according to any of claims 1 to 7, wherein a physical feature is selected for encoding the surface of a substrate to provide a primary encoding, which will not appear in the electrostatic image of a photocopier.

9. A substrate according to claim 8, wherein the physical feature encoding is in the form of a repeat pattern.

10. A substrate according to claim 8 or claim 9, wherein the physical feature encoding of a substrate comprises, embossing with inkless intaglio or embossing the surface by calendaring during manufacture of the substrate.

11. A substrate according to any of claims 1 to 10, wherein two or more different encoding techniques are combined in any substrate.

12. A substrate according to claim 11, wherein the identification features are formed by, impressing in the surface of a substrate onto which a security document is to be printed indentations and/or grooves in accordance with a first pattern which contains encoded therein a second pattern, to enable a security document printed on such a substrate to be identified by subjecting image data signals obtained from scanning the document to an appropriate mathematical algorithm to determine whether the second pattern can be found

in image data signals relating to the first pattern.

13. A substrate according to any of claims 1 to 12, wherein the pattern is encoded to produce multiple iterations of a code on the substrate.

14. A substrate according to any of claims 1 to 13, wherein the encoded pattern extends over selected areas which align with particular printed areas of the substrate.

15. A substrate according to claim 14, wherein the printed areas are selected so as to enhance the detection of the substrate surface variation during scanning and conversion of the image into image data signals.

16. A surface treated substrate in accordance with any of claims 1 to 15, having any lighter and darker regions visible in the surface of a treated sheet of substrate when illuminated for scanning, but not visible to the eye.

17. A substrate according to claim 16, which is embossed during its manufacture to form the identification features.

18. A substrate according to claim 16, wherein paper or plastics substrate material has mixed therewith a resin or lacquer or other material to provide a smooth surface for printing and an encoded structure is formed in the surface such that the actual surface of the substrate is sufficiently smooth to accept printing ink to enable a security document to be printed thereon, but at the same time contains a fine pattern of less smooth regions, which are less receptive of printing ink.

19. A substrate according to claim 16 wherein, the substrate surface is modified by a technique in which selected regions of a substrate describe a repeat identification pattern by being impregnated with a fluid such as a resin, or lacquer, such that the optical absorbtion or reflectance characteristics or optical density of the substrate is altered sufficiently as between impregnated and non-impregnated areas as to be discernable under incident light.

20. A substrate according to claim 16, which is surface etched by a laser beam, so as to produce cavities or grooves in the surface to be printed (or awaiting printing).

21. A substrate according to claim 16, wherein watermarking is used to vary the thickness and/or texture of a substrate, which variations and/or can be rendered visible under incident light and are used to form the primary and/or secondary encoding.

22. A security document substrate adapted to be identifiable as such by having detectable surface features therein according to any of claims 1 to 21, to enable identification as aforesaid.

23. A security document when printed on a substrate as claimed in any of claims 1 to 22.

24. A substrate on which a security document is to be printed, which is surface treated for use in the production of security documents so as to inhibit or degrade the reproduction of such security documents using a scanning process which converts the image into image data signals for controlling a printing process, in which a second control is introduced if surface encoding is detected by subjecting the image data signals to an appropriate algorithm, which second control serves to downgrade or inhibit the printing process so as to prevent the reproduction of the original document, or at least of a good quality reproduction thereof.

25. A document verification method by scanning the document and converting the optical information into electrical signals using a photosensitive device and in which for recognition purposes, a data processor is programmed to look for surface encoded information invisible to the eye, in the electrical signals which if detected in image data obtained from imaging and scanning the document, will generate a confirmation signal, validating the document, and vice versa.

26. A computer based document scanning device which is adapted to validate a document by checking that one or more patterns on one or more particular features, invisible to the

eye, are present in the document.